



U.S. Department of Transportation
Pipeline and Hazardous Materials
Safety Administration



IMPACT: Collaboration, Coordination, Competitive Review and Co-Funding Since 2002



Robert Smith
R&D Manager, DOT/PHMSA
Government/Industry Pipeline R&D Forum
June 24-25, 2009, Crystal City, VA



In Memoriam



Marina Q. Smith
September 2007



Thank You Everyone!

- **“Our” Efforts are Having an Impact to:**
 - Reducing Duplication
 - Leveraging Resources
 - Improving Research Quality
 - Technology Development
 - Strengthening of Consensus Standards
 - Generation and Promotion of General Knowledge



A Partnership in Strategy

- **Pipeline Safety Improvement Act of 2002**
 - Galvanized DOT/DOE/NIST and DOI coordination on research
 - Called for 10 Technical Program Elements
 - Increased Pipeline Safety R&D Authorizations
- **Blue Ribbon Panel Meetings**
 - Held in 2003 & 2004
 - Brought together Industry and Government Leaders and crafted much of the program structure and process



Pre-Award Summary

- **Government/Industry R&D Forums**
 - Held in 2003, 2005, & 2007
- **Research Workshops**
 - Coatings in 2005 Welding/Joining in 2006
 - Mechanical Damage in 2006
 - Ethanol in 2007
- **Gov/Industry Steering Committees**
 - Comprehensive and balanced
 - To develop and execute the agenda



Pre-Award Summary

- **Solicitations Issued**

- 9 Broad Agency Announcements
- 582 White Papers received and reviewed
- 188 Proposals received and reviewed
- 175 Different research organizations submitting

- **Merit Review Panels**

- Federal: DOI/MMS, DOC/NIST, DOE/NETL, USDA & EPA
- State: NAPSR
- Industry: AGA, AOPL/API, APGA, INGAA & NGA



Post-Award Summary

- **Research Awards from:**

- BAA: 120 (\$43M DOT + \$61M Industry)
- SBIR: 15 (\$2.1M DOT)
- Interagency: 9 (\$2.4M DOT + \$0.24M NIST/MMS + \$0.88M Industry)

Total: 144 (\$47.7M + \$62M Industry= \$109.7M)

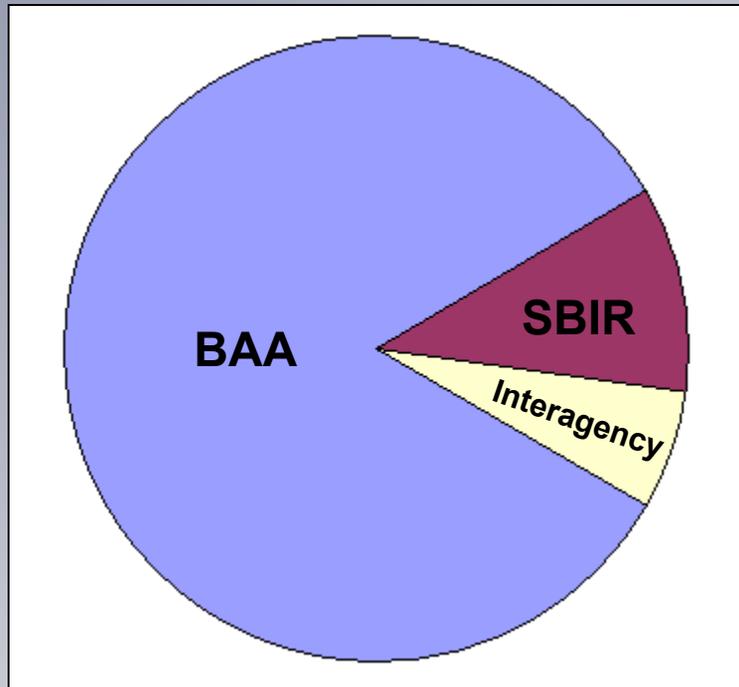
Total does not include 1 Earmark and 2 Unsolicited awards

98% Competitive

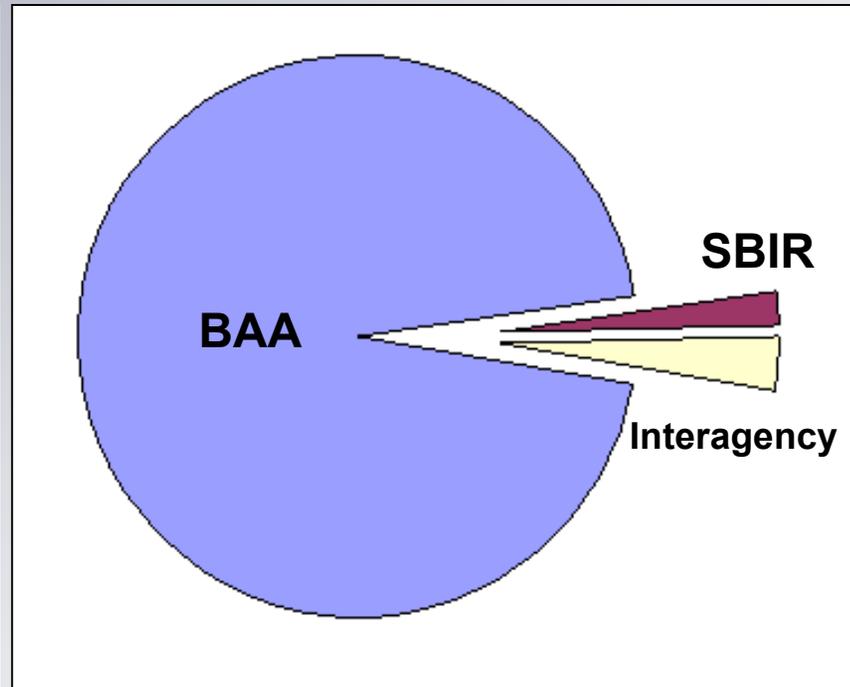


Post-Award Summary

By Project



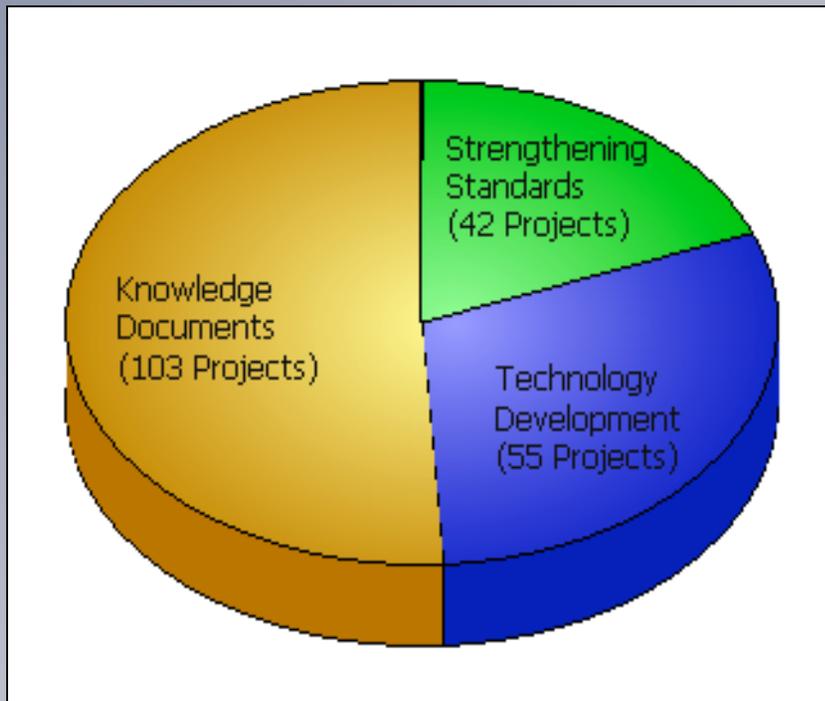
By Funding



Total: 144 (\$47.7M + \$62M Industry= \$109.7M)



Post-Award Relevance



Objective	Projects	PHMSA	Industry	Total
Strengthening Standards	42	\$12.64M	\$16.65M	\$29.29M
Technology Development	55	\$26.69M	\$29.37M	\$56.06M
Knowledge Documents	103	\$25.23M	\$38.35M	\$63.58M

Pipeline Types

Pipeline Types	# Projects	PHMSA \$	Co-Funding \$	Total \$
Hazardous Liquid	110	\$29 M	\$41 M	\$70 M
Gas Transmission	126	\$44 M	\$57 M	\$102 M
Gas Distribution - Steel	85	\$30 M	\$37 M	\$67 M
Gas Distribution - Non-Metallic	23	\$8 M	\$7 M	\$15 M

Pipeline Locations

Pipeline Locations	# Projects	PHMSA \$	Co-Funding \$	Total \$
Onshore	136	\$48 M	\$61 M	\$109 M
Offshore	45	\$15 M	\$21 M	\$36 M
Alaska	42	\$19 M	\$25 M	\$44 M

Projects can impact and be relevant in two or more areas. Because of this, counts and sums will amount to more than 100% of program totals.



Post-Award Relevance

Program Category	Objectives	PHMSA	Industry	Total	Total
Damage Prevention	Strengthening Standards	\$ 0.07M	\$ 0.08M	\$ 0.15M	
	Technology Development	\$ 1.76M	\$ 1.08M	\$ 2.84M	
	Knowledge Documents	\$ 0.42M	\$ 0.99M	\$ 1.42M	
Pipeline Assessment and Leak Detection	Strengthening Standards	\$ 5.45M	\$ 7.02M	\$ 12.48M	
	Technology Development	\$ 21.39M	\$ 24.20M	\$ 45.59M	
	Knowledge Documents	\$ 10.81M	\$ 15.23M	\$ 26.05M	
Defect Characterization and Mitigation	Strengthening Standards	\$ 2.32M	\$ 2.99M	\$ 5.31M	
	Technology Development	\$ 0.48M	\$ 0.52M	\$ 1.00M	
	Knowledge Documents	\$ 5.25M	\$ 6.44M	\$ 11.70M	
Improved Design, Construction and Materials	Strengthening Standards	\$ 4.57M	\$ 6.33M	\$ 10.91M	
	Technology Development	\$ 3.05M	\$ 3.56M	\$ 6.61M	
	Knowledge Documents	\$ 7.33M	\$ 13.74M	\$ 21.07M	
Enhanced Operation Controls and Human Factors Management	Strengthening Standards	\$ 0.00M	\$ 0.00M	\$ 0.00M	
	Technology Development	\$ 0.00M	\$ 0.00M	\$ 0.00M	
	Knowledge Documents	\$ 0.53M	\$ 0.49M	\$ 1.02M	
Risk Management and Communications	Strengthening Standards	\$ 0.00M	\$ 0.00M	\$ 0.00M	
	Technology Development	\$ 0.00M	\$ 0.00M	\$ 0.00M	
	Knowledge Documents	\$ 0.03M	\$ 0.03M	\$ 0.07M	
Safety Issues for Emerging Technologies	Strengthening Standards	\$ 0.21M	\$ 0.22M	\$ 0.43M	
	Technology Development	\$ 0.00M	\$ 0.00M	\$ 0.00M	
	Knowledge Documents	\$ 0.83M	\$ 1.40M	\$ 2.23M	



Post-Award Review

- **Reviews for relevance, quality and performance:**
 - Pre-Solicitation: R&D Forums and Workshops
 - Pre-Award: White Papers and Proposals
- **Post-Award Reviews**
 - Panelists
 - Other Federal Agencies and Standards Developing Organizations (pipeline operators)

Listing of Annual Peer Reviews

No.	Date	Peer Review ID	Complete	Projects Reviewed	Very Effective	Effective	Moderately Effective	Ineffective
1.	February 7-9, 2006	PHP-1-2006	Yes	31	29	2	0	0
2.	March 27-29, 2007	PHP-2-2007	Yes	27	26	1	0	0
3.	May 1, 6, & 14, 2008	PHP-3-2008	Yes	29	28	1	0	0



IMPACT: Technology Development

Technology Impact Metric	Count	Meter
Technology Projects	55	
Technology Demonstrations	26	
U.S. Patent Applications	13	
Commercialized Technologies ^A	9	

Category	Technology Projects	Technology Demonstrations	U.S. Patent Applications	Commercialized Technologies ^A	PHMSA (\$M)	Industry (\$M)	Total (\$M)
Damage Prevention	5	3	3	1	\$ 1.76M	\$ 1.08M	\$ 2.84M
Pipeline Assessment and Leak Detection	41	21	10	7	\$21.39M	\$24.20M	\$45.59M
Defect Characterization and Mitigation	2	1		1	\$ 0.48M	\$ 0.52M	\$ 1.00M
Improved Design, Construction and Materials	7	1			\$ 3.05M	\$ 3.56M	\$ 6.61M
Grand Totals:	55	26	13	9	\$26.69M	\$29.37M	\$56.06M

Footnotes:

A. Note: The measurement of "Commercialized Technologies" only occurs on non-active or completed projects.

Active Technology Projects: 25



No.	Activities ^A	Affected Pipeline Types ^B	Application Area ^C	PHMSA	Co-funding ^D	Total Investment	Technology Demonstrated	Commercialized (in whole/part)? [Show All Projects...]	Net Benefit
<i>Damage Prevention</i>									
1.	DTRS56-02-T-0005 , "Digital Mapping of Buried Pipelines with a Dual Array System"	HazLiq GasTrans Dist-Steel Dist-Non-Metal	Onshore	\$ 0.46M	\$ 0.53M	\$ 1.00M	Yes	Yes More ... (see Fast Facts)	Witten's patented technology is the first commercial system capable of producing highly accurate, three-dimensional maps and images efficiently and noninvasively (without digging) in conditions as much as ten feet underground and based on rapid computer analysis of radar images.
<i>Damage Prevention Total:</i>				\$ 0.46M	\$ 0.53M	\$ 1.00M	1	1	
<i>Pipeline Assessment and Leak Detection</i>									
2.	DTPH56-06-T-000010 , "Internal Corrosion Direct Assessment Detection of Water"	GasTrans Dist-Steel	Onshore	\$ 0.35M	\$ 0.35M	\$ 0.70M	Yes	Yes More ... (see Fast Facts)	This effort designed, developed and validated a wireless sensor system that can flow inside gas pipelines and detect the presence and location of water. The sensor system is in the form of a 1.5" diameter sphere that can roll along the pipe propelled by gas flow. This technology compliments the ICDA process and will help improve pipeline integrity and reduce the threats of internal corrosion for both piggable and unpiggable lines by enabling operators to determine if a line has any water accumulation and where it the accumulation sites are located.
3.	DTPH56-06-T-000009 , "Enhancing Direct Assessment with Remote Inspection through Coatings and Buried Regions"	HazLiq GasTrans	Onshore	\$ 0.22M	\$ 0.25M	\$ 0.47M	Yes  [View File...] (0.16MB)	Yes More ... (see Fast Facts)	A Non-Destructive Testing technology capable of anomaly inspection through most coatings less than 3mm thick. More ... (see Fast Facts)



No.	Activities ^A	Affected Pipeline Types ^B	Application Area ^C	PHMSA	Co-funding ^D	Total Investment	Technology Demonstrated	Commercialized (in whole/part)? [Show All Projects...]	Net Benefit
<i>Pipeline Assessment and Leak Detection</i>									
4.	DTPH56-05-T-0005 , "Cathodic Protection Current Mapping In-Line Inspection Technology"	HazLiq GasTrans Dist-Steel	Onshore Offshore	\$ 0.40M	\$ 0.45M	\$ 0.85M	Yes	Yes More ... (see Fast Facts)	The Baker Hughes In-line Cathodic Protection Inspection tool is the first method to assess the effectiveness of your cathodic protection system from INSIDE the pipe, bringing operators new benefits. The first PRO-ACTIVE in-line inspection tool - identifies gaps in protection BEFORE damage occurs. More ... (see Fast Facts)
5.	DTRS56-05-T-0002 , "Validation and enhancement of long range guided wave ultrasonic testing: A key technology for DA of buried pipelines"	HazLiq GasTrans Dist-Steel	Onshore	\$ 0.53M	\$ 0.62M	\$ 1.15M	Yes  [View File...] (0.20MB)	Yes More ... (see Fast Facts)	This project developed and tested in the field enhanced methods of using ultrasonic guided waves, employing a physical focus of the ultrasonic energy to increase sensitivity for detection of corrosion and other defects in pipelines. This method is now implemented in both hardware and software in the Plant Integrity Teletest® Focus™ system. This allows classification of the severity of defects detected from guided wave tests (D'Zurko et al, Pipeline and Gas Journal, June 2008 pp 36-44). Recommendations regarding best practice for operating guided wave test equipment have led to improved training and certification for guided wave test technicians in accordance with the international standard ISO 9712.
6.	DTRS56-04-T-0012 , "Hazardous Liquids Airborne Lidar Observation Study (HALOS)"	HazLiq GasTrans Dist-Steel Dist-Non-Metal	Onshore Offshore Alaska	\$ 0.55M	\$ 0.55M	\$ 1.10M	Yes	Yes More ... (see Fast Facts)	This research significantly enhanced the capability of the current ITT Airborne Natural Gas Emission Lidar (ANGEL) technology to detect methane leaks in pipelines. Confidence was raised in the ANGEL ability to detect small liquid leaks as well. An integration and demonstration of GIS imagery, Midwave Infra-red cameras and Differential Absorption Lidar (DIAL) has resulted in near real-time DIAL collection and data processing improving from 3-4 weeks to one day. Improvements to speed up the ANGEL route and mission planning software processes resulted in a drastic reduction in cycle time. At the conclusion of this research, Route Generation can now be accomplished in the field and requires only 1 hour of effort to generate 100 miles of pipeline routes. This is a 30X improvement in speed.



No.	Activities ^A	Affected Pipeline Types ^B	Application Area ^C	PHMSA	Co-funding ^D	Total Investment	Technology Demonstrated	Commercialized (in whole/part)? [Show All Projects...]	Net Benefit
<i>Pipeline Assessment and Leak Detection</i>									
7.	DTRS56-02-T-0007 , "Enhancement of the Long-Range Ultrasonic method for the Detection of Degradation in Buried, Unpiggable Pipelines"	HazLiq GasTrans Dist-Steel	Onshore Offshore	\$ 0.65M	\$ 0.63M	\$ 1.28M	Yes	Yes More ... (see Fast Facts)	Improvements were integrated in the TeleTest operating software that facilitates the new sound beam focusing technique. This wave focusing improves the sensitivity and range of inspection and identifies which quadrant of the pipe circumference contains the defect measured in cross sectional area. Hardware improvements were also made to support the multi wave focusing.
8.	DTRS56-01-X-0023 , "Airborne LIDAR Pipeline Inspection System (ALPIS) Mapping Tests"	GasTrans Dist-Steel Dist-Non-Metal	Onshore Alaska	\$ 2.24M		\$ 2.24M	Yes  [View File...] (7.27MB)	Yes More ... (see Fast Facts)	A helicopter based fast, efficient, and accurate tool for detecting and mapping natural gas and hazardous liquid pipeline leaks. This work enabled an engineering research prototype to become a commercialized leak detection and mapping system that the pipeline industry can now use.
<i>Pipeline Assessment and Leak Detection Total:</i>				\$ 4.96M	\$ 2.86M	\$ 7.82M	7	7	



No.	Activities ^A	Affected Pipeline Types ^B	Application Area ^C	PHMSA	Co-funding ^D	Total Investment	Technology Demonstrated	Commercialized (in whole/part)? [Show All Projects...]	Net Benefit
<i>Defect Characterization and Mitigation</i>									
9.	DTRS56-03-T-0009, "Advanced Welding Repair and Remediation Methods for In-service Pipelines"	HazLiq GasTrans	Onshore Alaska	\$ 0.41M	\$ 0.45M	\$ 0.86M	Yes  [View File...] (2.13MB)	Yes More ... (see Fast Facts)	The development of an automated system that takes 30 minutes to mount on the pipeline and 36 minutes to make all the fill passes (1.1 hours total) at an estimated cost of \$176.00 per reinforcement sleeve (Type A). If welding was done manually, it could take 2.5 hours total to make the entire fill pass at an estimated cost of \$280.85 per sleeve. The new automated system is approximately 2.3 times faster and 62% cheaper than manual welding. Work continues by Bug-O Systems to reduce the system mounting time in order to further improve cost effectiveness when compared to manual welding.
<i>Defect Characterization and Mitigation Total:</i>				\$ 0.41M	\$ 0.45M	\$ 0.86M	1	1	
Grand Totals:				\$ 5.84M	\$ 3.85M	\$ 9.70M	9	9	

Footnotes:

- A. Program strategies and the research projects within them.
- B. Short term benefactors are operators or owners of hazardous liquid, natural gas transmission or distribution pipelines. General Public are long-term benefactors.
- C. Area in which research outputs apply within onshore, offshore or Arctic pipelines.
- D. PHMSA co-funds research with many different pipeline stakeholder groups.



IMPACT: Consensus Standards

Seq	Standard #	Standard Title	Projects Affecting Standards	Standards Revised	Out to Committee	Pending (Project Active)	Not Determined	PHMSA	Industry	Total
<i>American Petroleum Institute (API)</i>										
1.	Publ 1163	In-line Inspection Systems Qualification Standard	1		1			\$ 0.56M	\$ 0.61M	\$ 1.17M
2.	RP 1166	Excavation Monitoring and Observation	1		1			\$ 0.07M	\$ 0.08M	\$ 0.15M
3.	RP 579	Fitness-for-Service	2			1	1	\$ 0.89M	\$ 1.02M	\$ 1.91M
4.	Spec 5L	Specification for Line Pipe	1				1	\$ 0.14M	\$ 0.39M	\$ 0.53M
5.	Std 1104	Welding of Pipelines and Related Facilities	9	2	2	1	4	\$ 3.87M	\$ 5.73M	\$ 9.61M
6.	TR 939-D	Stress Corrosion Cracking of Carbon Steel in Fuel Grade Ethanol	2			2		\$ 0.51M	\$ 0.53M	\$ 1.04M
<i>American Society of Mechanical Engineers (ASME)</i>										
1.	B31.12	Hydrogen Piping and Pipelines	1				1	\$ 0.80M	\$ 0.76M	\$ 1.57M
2.	B31.3	2004 Process Piping	1				1	\$ 0.14M	\$ 0.39M	\$ 0.53M
3.	B31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids	4				4	\$ 1.63M	\$ 2.91M	\$ 4.55M
4.	B31.8	Gas Transmission and Distribution Piping Systems	6			2	4	\$ 2.82M	\$ 4.89M	\$ 7.71M
5.	B31.8 BS 7910	Gas Transmission and Distribution Piping Systems	1				1	\$ 0.17M	\$ 0.16M	\$ 0.33M
6.	B31.8S	Managing System Integrity of Gas Pipelines	3		1	1	1	\$ 0.78M	\$ 0.29M	\$ 1.07M
7.	B31G/RSTRENG	Manual: Determining Remaining Strength of Corroded Pipelines	1				1	\$ 0.87M	\$ 0.80M	\$ 1.68M



IMPACT: Consensus Standards

Seq	Standard #	Standard Title	Projects Affecting Standards	Standards Revised	Out to Committee	Pending (Project Active)	Not Determined	PHMSA	Industry	Total
<i>American Society for Testing and Materials (ASTM)</i>										
1.	D-4806	Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel	2			2		\$ 0.51M	\$ 0.53M	\$ 1.04M
2.	D2513	Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings	1				1	\$ 0.31M	\$ 0.31M	\$ 0.62M
3.	D2657	Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings	1				1	\$ 0.31M	\$ 0.31M	\$ 0.62M
4.	E1820	Standard Test Method for Measurement of Fracture Toughness	1				1	\$ 0.80M	\$ 0.76M	\$ 1.57M
5.	E1961-98(2003)e1	Standard Practice for Mechanized Ultrasonic Examination of Girth Welds Using Zonal Discrimination with Focused Search Un	1				1	\$ 0.35M	\$ 0.46M	\$ 0.81M
6.	E2472-06	Standard Test Method for Determination of Resistance to Stable Crack Extension under Low-Constraint Conditions	1				1	\$ 0.55M		\$ 0.55M
<i>American Welding Society (AWS)</i>										
1.	A5.X	Filler Metal Specifications	1				1	\$ 0.60M	\$ 1.68M	\$ 2.29M
2.	B4.0	Standard Methods for Mechanical Testing of Welds	1				1	\$ 0.60M	\$ 1.68M	\$ 2.29M
3.	D10.12	Guide for Welding Mild Steel Pipe	1				1	\$ 0.14M	\$ 0.39M	\$ 0.53M



IMPACT: Consensus Standards

Seq	Standard #	Standard Title	Projects Affecting Standards	Standards Revised	Out to Committee	Pending (Project Active)	Not Determined	PHMSA	Industry	Total
<i>Det Norske Veritas (DNV)</i>										
1.	DNV RP F-101	Submarine Pipeline Systems, October 2005	1				1	\$ 0.17M	\$ 0.16M	\$ 0.33M
<i>NACE International (NACE)</i>										
1.	RP 0105-2005	Liquid-Epoxy Coatings	1			1		\$ 0.14M	\$ 0.39M	\$ 0.53M
2.	RP 0169	Control of External Corrosion on Underground or Submerged Metallic Piping Systems	1		1			\$ 0.08M	\$ 0.08M	\$ 0.16M
3.	RP 0169-2002	Control of External Corrosion on Underground or Submerged Metallic Piping Systems	1				1	\$ 0.45M		\$ 0.45M
4.	RP 0178-2003	Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to Be Lined for	1			1		\$ 0.14M	\$ 0.39M	\$ 0.53M
5.	RP 0204-2004	Stress Corrosion Cracking (SCC) Direct Assessment Methodology	2			2		\$ 0.63M	\$ 0.97M	\$ 1.61M
6.	RP 0303-2003	Field-Applied Heat-Shrinkable Sleeves	1			1		\$ 0.14M	\$ 0.39M	\$ 0.53M
7.	RP 0394-94	Application, Performance, and Quality Control of Plant-Applied, Fusion-Bonded Epoxy External Pipe Coating	1			1		\$ 0.24M	\$ 0.28M	\$ 0.52M
8.	RP 0502	Pipeline External Corrosion Direct Assessment Methodology	12		3	8	1	\$ 2.90M	\$ 3.52M	\$ 6.43M
9.	RP 0694-94	Commercial Blast Cleaning?	1				1	\$ 0.24M	\$ 0.28M	\$ 0.52M



IMPACT: Consensus Standards

Seq	Standard #	Standard Title	Projects Affecting Standards	Standards Revised	Out to Committee	Pending (Project Active)	Not Determined	PHMSA	Industry	Total
<i>NACE International (NACE)</i>										
10.	SP 0206-2006	Internal Corrosion Direct Assessment Methodology for Pipelines Carrying Normally Dry Natural Gas (DG-ICDA)	1		1			\$ 0.19M	\$ 0.31M	\$ 0.50M
11.	SP 0502	Pipeline External Corrosion Direct Assessment Methodology	1			1		\$ 0.14M	\$ 0.29M	\$ 0.43M
12.	TG 294	Above ground testing for coating condition assessment	1		1			\$ 0.13M	\$ 0.62M	\$ 0.75M
13.	TG 305	Wet Gas ICDA Standard	2	1		1		\$ 0.47M	\$ 0.36M	\$ 0.83M
14.	TG 315	Liquid Petroleum ICDA Standard	1	1				\$ 0.18M	\$ 0.31M	\$ 0.49M
<i>National Fire Protection Association (NFPA)</i>										
1.	59A	Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)	1		1			\$ 0.21M	\$ 0.22M	\$ 0.43M
<i>Society for Protective Coatings (SSPC)</i>										
1.	SSPC-PA1	Shop, Field, and Maintenance Painting	1				1	\$ 0.14M	\$ 0.39M	\$ 0.53M



IMPACT: General Knowledge

Knowledge Promotion Metric	Count	Meter
Final Reports Publicly Available	55	
Conference or Journal Papers	49	
Public Events	29	
U.S. Patent Applications	13	
Annual Peer Reviews Held	3	

Event Type	Events Held	Stakeholders Reached
Blue Ribbon Panel	2	39
Gov/Industry R&D Forums	3	565
Interagency Coordination Meetings	13	101
R&D Workshops/Conferences	10	1445
Safety Advisory Committees	1	30
Grand Totals:	29	2180

Website Usage Metric	Measure
Total Number of Hits	11,008,628
Average Number of Hits/Month	150,803
Files Downloaded (since 1/01/2008)	327,261



We've had an Impact!

- **So lets continue:**

- Reducing Duplication
- Leveraging Resources
- Improving Research Quality
- Technology Development
- Strengthening of Consensus Standards
- Generation and Promotion of General Knowledge



<http://primis.phmsa.dot.gov/rd/>

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U.S. Department
of Transportation

R&D Home

Program Strategy

Program Performance

**Internal, External,
Stakeholder, & Peer
Reviews**

**Technology
Demonstrations**

**Pipeline Safety
Improvement Act
of 2002**

Announcements

Recent Projects

Meetings/Events

Success Stories

Links

Contacts

Feedback

**PHMSA
Communications**

Research & Development

Welcome to PHMSA's Pipeline Safety Research and Development Website.

This site is dedicated to the coordination and dissemination of Research and Development information related to Pipeline Safety.

PHMSA conducts and supports research to support regulatory and enforcement activities and to provide the technical and analytical foundation necessary for planning, evaluating, and implementing the pipeline safety program. PHMSA is sponsoring research and development projects focused on providing near-term solutions that will increase the safety, cleanliness, and reliability of the Nation's pipeline system.

Recent R&D projects are focused on: leak detection; detection of mechanical damage; damage prevention; improved pipeline system controls, monitoring, and operations; and, improvements in pipeline materials. These projects are addressing technological solutions that can quickly be implemented to improve pipeline safety.

In 2003, [a study by the Government Accountability Office \(GAO\)](#) found that the PHMSA Pipeline Safety R&D Program is aligned with PHMSA's mission and pipeline safety goals.





Thank You!